REMARKS

Applicants appreciate the time taken by the Examiner to review Applicants' present application. This application has been carefully reviewed in light of the Official Action mailed March 22, 2005. Applicants respectfully request reconsideration and favorable action in this case. Applicants appreciate the Examiner indicating the allowability of Claims 33-37. Applicants have amended Claim 33 to correct a typographical error. This amendment is not intended to change the scope of the claim.

Rejections under 35 U.S.C. § 102

Claims 30-32 and 38-40 stand rejected as anticipated by U.S. Patent No. 6,167,965 ("Bearden"). Applicants have cancelled these claims with out prejudice or disclaimer.

Rejections under 35 U.S.C. § 103

Claims 1-32 and 38-55 stand rejected as obvious over U.S. Patent No. 6,167,965 ("Bearden") in view of U.S. Patent No. 6,119,710 ("Brown").

In order to establish a prima facie case of obviousness, the Examiner must show: that the prior art references teach or suggest all of the claim limitations; that there is some suggestion or motivation in the references (or within the knowledge of one of ordinary skill in the art) to modify or combine the references; and that there is a reasonable expectation of success. M.P.E.P. 2142, 2143; In re Vaeck, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). The Examiner must explain with reasonable specificity at least one rejection – otherwise, the Examiner has failed procedurally to establish a prima facie case of obviousness. M.P.E.P. 2142; Ex parte Blanc, 13 U.S.P.Q.2d 1383 (Bd. Pat Application. & Inter. 1989). When the motivation to combine the teachings of the references is not immediately apparent, it is the duty of the Examiner to explain why the combination of the teachings is proper. Ex parte Skinner, 2 U.S.P.Q.2d 1788, 1790 (Bd. Pat. App. & Inter. 1986).

The Applicants respectfully point out that the Examiner has failed to establish a prima facie case of obviousness. More specifically, each of the claim limitations is not present in the references, nor has the Examiner shown that there is any suggestion or motivation in the references to combine or modify them. Consequently, the rejection must fail.

<u>Independent Claims 1, 11, 20, 41 and 50 - Failure to Disclose a First and Second Mode of Operation or Switching Between Modes</u>

With respect to independent Claims 1, 11, 20, 41 and 50 the Examiner states:

> Regarding claims 1, 11, 20, 41 and 50, Bearden discloses . . . a controller coupled to the first pressure sensor and the second pressure sensor (Fig. 1M), the controller configured to: operate according to a second mode of operation, the controller generates the valve control signal based on a measured pressure at a particular pressure sensor (column 9, lines 37-55); and switch between the first mode of operation and the second mode of operation according to a predefined parameter.
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> Bearden fails to disclose operating according to a first mode of operation, wherein during the first mode of operation the controller generates a valve control signal based on a differential between a first pressure and a second pressure.
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> However, Brown discloses operating according to a first mode of operation wherein during the first mode of operation, the controller generates a valve control signal based on a differential pressure between the first pressure and the second pressure (column 3, lines 40-62).
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> It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the teachings of Bearden with the teachings of Brown in order to provide improved gas flow system that accurately measures gas flow during delivery of gas to a processing chamber.

Applicants respectfully submit that Bearden and Brown do not, alone or in combination, teach or suggest each of the limitations of the independent claims of the present invention. More particularly, Bearden and Brown do no teach or suggest a flow control device that operates according to two modes of operation in which the valve control signal is generated or flow rate determined based on different parameters. Even more particularly, Bearden and Brown do not teach or suggest a flow control device or method that controls flow based on a first mode of operation based on differential pressure and a second mode of operation based on a single pressure. Furthermore, neither Bearden nor Brown, alone or in combination, teach or suggest switching between these two modes of operation as recited in each of the independent claims of the invention.

Claim 1 recites a flow control device with a controller that is configured to "operate according to a first mode of operation, wherein during the first mode of operation the controller generates a valve control signal based on a differential between the first pressure and the second pressure, operate according to a second mode of operation, wherein during the second mode of operation the controller generates the valve control signal based on a measured pressure at a particular pressure sensor; and switch between the first mode of operation and the second mode of operation according to a predefined parameter." As understood by those in the art, flow controllers are used to regulate flow of a gas by opening and closing a valve to various degrees to allow more or less flow. In essence, a flow controller acts as a limiter that controls flow through valve between "full" flow associated with a fully open valve to "zero" flow associated with a fully closed valve. As recited in Claim 1, the flow control device of the present invention can control a valve according to *two* modes of operation. In the first mode of operation the device of Claim 1 uses *differential pressure* as a basis for controlling the valve and in the second mode of operation the device uses the *pressure at a particular sensor* for controlling the device. The claimed invention can *switch* between these two modes of operation to change the manner in which claimed device controls valve position. Thus, as recited in Claim 1, the limitations of the present invention allow the controller to control the valve position based on the differential pressure across a flow restriction *or* based on the pressure at a single sensor, and further the controller can switch between these modes (and therefore switch how it regulates the valve opening and closing) upon the occurrence of some predefined event.

Bearden fails to teach operating according to the second mode of operation or switching between the two modes of operation according to a predefined parameter. Bearden is drawn to a submersible pump. The submersible pump of Bearden acts as an engine to *create* a flow of a liquid from a well bore where the pump can use a variable speed motor to pump more or less liquid once the flow has been created by the pump. The controller of the pump can include a conventional microprocessor that can be programmed to record sensor data in memory or to process the sensor data and communicate the processed or unprocessed sensor data to another location in the wellbore. *See*, Bearden, col. 9, lines 37-56. Additionally, the submersible pump can include a motor control to control the variable speed motor to change pumping speed.

In contrast to Claim 1 of the present invention, the controller and motor controller of FIGURE 1M cited by the Examiner do not produce a valve control signal based on any

parameter, much less the pressure at a particular sensor. Column 9, lines 37-56 simply state that some generalized control scheme can be implemented, but does not teach or suggest controlling a valve based on the pressure at single sensor or how such a pressure based control scheme is implemented. Thus, Bearden as cited by the Examiner does not teach or suggest to "operate according to a second mode of operation, wherein during the second mode of operation the controller generates the valve control signal based on a measured pressure at a particular pressure sensor" as recited in Claim 1.

Furthermore, while the speed of the motor of Bearden may be variable, there is no teaching or suggestion that the controller changes the parameters it uses to control the speed of the pump motor. Thus, in Bearden as cited by the Examiner, the controller does not appear "switch modes of operation" between modes of operation that perform control based on different parameters, and certainly does not switch modes of operation from controlling flow based on differential pressure to controlling flow based on a single pressure. Thus, Bearden does not support the switching modes of operation recited in Claim 1.

Brown does not remedy these deficiencies of Bearden. Brown is drawn to a mass flow controller that controls flow based on a differential pressure. *See,* Brown, col. 3, lines 40-62; col. 15, line 57 through col. 15, line 41. A change in pressure over time at a calibration volume can be used to adjust the coefficients used when determining the mass flow using the differential pressure, where adjustment of control valve 208 appears to occur according to a single mode of operation in which the differential pressure is used (e.g., the controller compares the output of EQN. 2 to the set point to determine whether to open or close a valve). Thus, Brown does not teach or suggest generating a valve control signal to control a valve based on a differential pressure in one mode of operation and based on the pressure at a single pressure sensor in a second mode of operation (as recited in Claim 1). Moreover, Brown does not teach or suggest any method of switching between two modes of operation by which the valve control signal is generated (as recited in Claim 1), much less switching between a first mode based on differential pressure and a second mode based on a single pressure.

Applicants therefore submit that the cited references do not teach a controller that generates a valve control signal according to two modes of operation, one in which the valve control signal is generated based on the pressure differential across a restriction and one in which the valve control signal is generated based on the pressure at a single sensor.

Moreover, there is no teaching or suggestion in either of the references of a controller in a flow control device that can switch between generating the valve control signal according to the two modes of operation. Consequently, Applicants respectfully submit that Bearden and Brown, alone or in combination, do not teach or suggest each of the limitations of the claimed invention. Applicants therefore respectfully request allowance of independent Claim 1 and the respective dependent Claims. For similar reasons, Applicants also respectfully request allowance of independent Claims 11, 20, 41 and 50 and their respective dependent claims.

Failure To Show Motivation to Combine

Applicants further submit that the Examiner has not provided sufficient motivation to combine the references. As an initial matter, Bearden is drawn to submersible pumps used in oil (petroleum) wells while Brown is drawn to a mass flow controller used in semiconductor processing. The Examiner simply states that "it would have been obvious to a person of ordinary skill of art at the time the invention was made to modify the teaching of Bearden with the teachings of Brown in order to improved gas flow system that accurately measures gas flow during the delivery of gas to a processing chamber." No particular teachings in any of the references are pointed out that would lead one of ordinary skill in the art to make such modification to a submersible oil pump to allow it to provide gas flow to a processing chamber.

Since the motivation to combine the teachings of the references is not immediately apparent, and the art areas of submersible oil pumps and gas flow delivery systems for the semiconductor industry are so disparate, Applicants respectfully request the Examiner explain why the combination of the teachings is proper or withdraw the rejection based on this combination of references.

Thus, Applicants respectfully submit that there is no motivation to combine the references. Moreover, even if combined the references fail to teach or suggest a controller that generates a valve control signal according to two modes of operation, one in which the valve control signal is generated based on the pressure differential across a restriction and one in which the valve control signal is generated based on the pressure at a single sensor, and switches between these modes of operation for generating the valve control signal.

Based on the failure of a motivation to combine and the fact that even in combination the references fail to teach or suggest the invention as claimed, Applicants respectfully request allowance of independent Claims 1, 11, 20, 41 and 50 and their respective dependent Claims.

Dependent Claims 2 and 21 – Failure to Teach or Suggest Valve Between Inlet and Outlet

With respect to Claims 2 and 21, the Examiner states that "Bearden discloses a valve responsive to the valve control signal located between the inlet and the outlet (FIG. 3D) and coupled to the controller (FIG. 1M); opening and closing a valve responsive to a valve control signal (column 36, lines 25-32)."

FIGURE 3D does not show or otherwise disclose a valve that receives a valve control signal from the submersible pump controller. The description of FIG. 3D reads:

> FIG. 3D is a booster pump configuration, in which the electrical submersible pump is used as a booster pump to increase the incoming pressure. As is shown, the electrical submersible pump 344 is installed in a shallow set vertical casing commonly known as a "can". An incoming line 346 is connected to the can. It feeds fluid into the can and electrical submersible pump 344. Electrical submersible pump 344 lifts the fluid through tubing 348, 352. Depending upon the particular application, several booster pumps can be connected together in series or in parallel. In the series connection, the discharge of one booster is connected to the feed of a second stage booster. In such a system, the flow rate through the various pump stays the same while the pressure increases as the fluid flows from one booster to the next. On the other hand, in a parallel connection, the boosters are connected to a common discharge manifold whereby the discharge pressure is the same, but the production rates are cumulative. Electrical submersible pumps are used as boosters to add pressure to long pipelines for pumping produced fluids to storage and processing facilities. Electrical submersible pumps are also used as boosters for increasing the pressure of water injection systems in water flood projects.

See, Bearden, col. 26, lines 8-29. Column 36, lines 25-32 describe that a downhole computer can command a downhole tool, such as a packer, sliding sleeve or valve to open close, or take other actions if required if certain sensed parameters are outside a normal or well zone operating range. The downhole computer is responsible for a variety of electromechnical devices in a particular downhole. FIGURE 4A illustrates how an undersea oil well can be divided into zones with a downwhole computer responsible for each zone in the well (*See,* FIGURE 4B). The downhole computer system controls a valve to shut off oil production based

on particular operating parameters. *See*, Bearden, col. 36, lines 35-31. Thus, the valve referenced in the passages cited by the Examiner is a valve that is controlled not by the controller of the submersible pump, but by a downhole computer system that is responsible for several zones and tools in an oil well.

Moreover, there is no teaching or suggestion in Bearden as cited by the Examiner that the downhole computer system operates according to one mode of operation in which it generates a valve control signal based on the differential pressure across a restriction in one mode of operation, generates the valve control signal based on the pressure in the second mode of operation and switches between the two modes of operation based on a predefined parameter. Consequently, there is no teaching or suggestion that the valve cited by the Examiner is responsive to the valve control signals generated by a controller that operates according to Claim 1. Therefore, Applicants respectfully request allowance of Claim 2 and, for similar reasons, Claim 21.

<u>Dependent Claims 5, 14, 24, 44 and 53 – Failure to Teach or Suggest the Predefined Parameter is Pressure Differential Threshold</u>

As recited in Claim 5, the switch between the modes of operation for generating the valve control signal occur based on "a pressure differential threshold." According to this feature of the present invention, when a particular differential pressure is reached, the controller switches modes of operation for generating the valve control signal. Claims 14, 24, 44 and 53 contain similar recitations. In rejecting Claims 5, 24, 44 and 53 the Examiner cites Bearden, Fig 2A. However, Bearden does not use a pressure differential threshold for switching the mode of operation by which a valve control signal is generated (or flow rate determined). Rather, Bearden compares a pressure (step 215) to a pressure threshold, not a pressure differential to a pressure differential threshold to alter the operating conditions of the pump. *See*, Bearden, col. 12, line 56 through col. 13, line 43. The operating conditions of the pump do not appear to include the manner in which a valve control signal is generated or flow rate determined. As Bearden does not appear to teach or suggest the use of a pressure differential threshold for changing the manner in which a valve control signal is generated or the manner in which a flow rate is determined, Bearden does not teach or suggest all of the features of Claims 5, 14, 24, 44 or 53. Consequently, Applicants respectfully request allowance of these claims. Furthermore, as Bearden does not teach or suggest comparing a pressure differential to a

pressure differential threshold to determine the mode of operation under which a valve control signal is generated or a flow rate determined, Bearden does not teach or suggest the recitations of Claims 6, 7, 15, 16, 25, 26, 45, 46, 54 and 55 (which depend from Claims 5, 14, 24, 44 and 53) and Applicants therefore respectfully request allowance of these claims.

Dependent Claims 8, 17, 27 and 47 – Failure to Teach or Suggest Calculating Pressure Differential Threshold

Claim 8 recites "wherein the controller is further configured to calculate the pressure differential threshold based on the differential between the first pressure and the second pressure, a supply pressure and a valve position." Thus, the threshold that is used to determine the mode of operation that the controller will use to generate the valve control signal or determine a flow rate is based on the differential between the first pressure and second pressure (e.g., the pressure differential across the restriction), a supply pressure and a valve position. Claims 17, 27 and 47 include similar recitations. In rejecting Claims 8, 17, 27 and 47, the Examiner simply cites Figure 2DD. The entire discussion of FIGURE 2DD of Bearden reads:

> The electrical submersible pump 11 of the present invention may be utilized to monitor flow rates. FIG. 2DD is a flowchart representation of data processing implemented steps for monitoring flow rates within the wellbore. The process begins at software block 1219 and continues at software block 1221, wherein the controller 411 is utilized to monitor and calculate flow rates and/or flow volumes. Next, in accordance with software block 1223, the controller 411 is utilized to compare the calculated flow rates and/or volumes to predetermined goals and/or limits. In software block 1225, the controller 411 is utilized to determine whether the goals and/or limits have been met; if so, the controller 411 is returned to software block 1221; if not, in accordance with software block 1227, the controller 411 is utilized to alter at least one operating condition in accordance with program instructions. Next, in accordance with software blocks 1229, 1231, 1233, the controller 411 is utilized to record the event, to optionally communicate the occurrence of the event to remotely located surface or subsurface equipment, or to optionally communicate a command to remotely located surface or subsurface equipment. The process ends at software block 1235.
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> For all of the foregoing data processing operations, the "recordation" or "recording" of an "event" can signify the storage in memory of any or all of (1) the sensed raw data, (2) the condition data, (3) intermediate or ultimate calculations of one or more pump or wellbore parameters, (4) the relative date/time of

> occurrence of the event, (5) the frequency or total number (count) of the events, (6) a record or log of the communication of the data and any associated command to any other surface or wellbore location, (7) acknowledgement of receipt of the data or command from any other wellbore or surface location.

Thus, while the electrical submersible pump of Bearden may be used as a flow meter, there is simply no teaching or suggestion in the portion of Bearden cited by the Examiner of calculating a pressure differential threshold by which the mode of operation of the controller is determine based on based on the differential between the first pressure and the second pressure, a supply pressure and a valve position. Therefore, Applicants respectfully request allowance of Claims 8, 17, 27 and 47.

Dependent Claims 10, 19, 29 and 49 – Failure to Teach or Suggest Generating an Alarm

Claim 10 recites to "monitor a valve for a change in valve position and if the change in valve position is greater than a predetermined amount, generate an alarm." Claims 19, 29 and 49 include similar recitations. In rejecting these Claims, the Examiner cites Figure 2B and column 13, lines 25-51. Column 13, lines 25-51 of Bearden read:

> Controller 411 may also control pump flow rates, as is depicted in flowchart form in FIG. 2B. The process begins at software block 229, and continues to software block 231, wherein controller 411 receives sensor data from flow meters which provide a continuous or intermittent measure of the amount of fluid flowing from the electrical submersible pump. In accordance with software block 233, controller 411 compares the actual flow rate with one or more desired flow rates. In software block 235, controller 411 determines whether the actual pump flow rate corresponds with the desired pump flow rates; if so, the process continues at software block 231 by continuing the monitoring operations; if not, the process continues at software block 237 wherein controller 411 is utilized to alter one or more operations conditions as per program instructions. For example, controller 411 may direct commands to motor controller 412 which increase or decrease the operating speed of the electrical submersible pump in order to match the actual pump flow rate with the desired pump flow rate. In accordance with the present invention, controller 411 can either monitor the velocity of the fluid directly, or it can calculate the volume of the fluid flow. Of course, the quantity of fluid flowing in a conduit is directly proportional to the velocity of the fluid. More specifically, the quantity of fluid flowing in a conduit is the product of the cross-sectional area of the conduit carrying the fluid and the velocity of the fluid flowing in the conduit.

There is simply no teaching or suggestion of monitoring the position of a valve to determine if the change in valve position is greater than some predetermined amount and, if so, generating an alarm. Therefore, Applicants respectfully request allowance of Claims 10, 19, 29 and 49.

New Claims

New Claims 56-61 are added to more particularly point out distinguishing features of the present invention. More specifically, new Claim 56 is drawn to a flow control device that has similar limitations to allowed Claim 33 and new Claim 59 is drawn to a method that has similar limitations to allowed Claim 33. Applicant submits that no new matter has been added and requests allowance of Claims 56-61.

Applicants have now made an earnest attempt to place this case in condition for allowance. Other than as explicitly set forth above, this reply does not include an acquiescence to statements, assertions, assumptions, conclusions, or any combination thereof in the Office Action. For the foregoing reasons and for other reasons clearly apparent, Applicants respectfully request full allowance of the pending claims. The Examiner is invited to telephone the undersigned at the number listed below for prompt action in the event any issues remain.

The Director of the U.S. Patent and Trademark Office is hereby authorized to charge any fees or credit any overpayments to Deposit Account No. 50-3183 of Sprinkle IP Law Group.

Respectfully submitted,

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